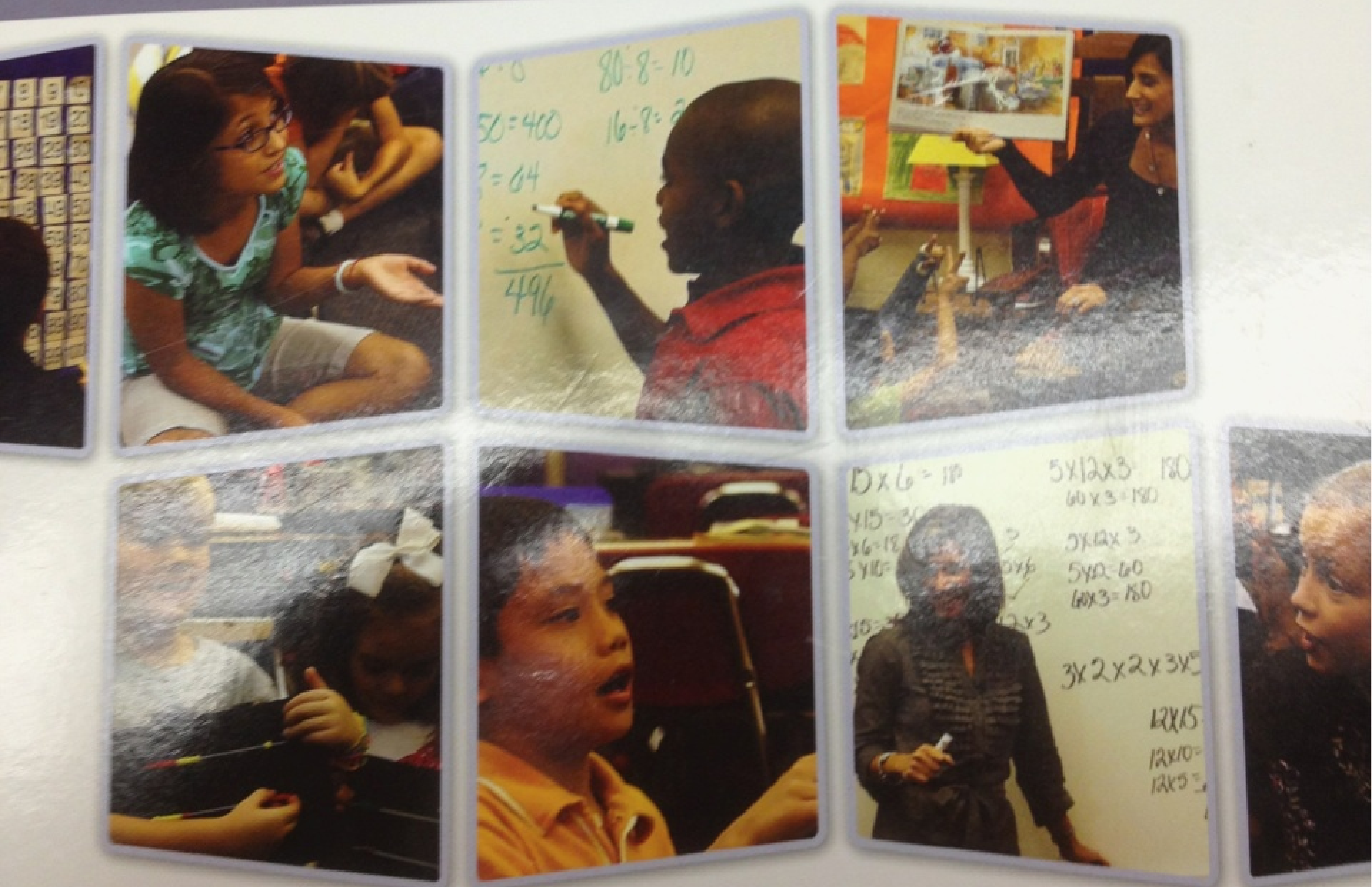
NUMBER TALKS

HELPING CHILDREN BUILD **MENTAL MATH** AND **COMPUTATION** STRATEGIES

GRADES K–5

- More than 850 purposefully designed number talks
- DVD featuring 19 number talks filmed in actual classrooms



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A Multimedia Professional Learning Resource

Key Components of Number Talks

1. Classroom environment and community
2. Classroom discussions
3. The teacher's role
4. The role of mental math
5. Purposeful computation problems

Classroom Discussions

During a number talk, the teacher writes a problem on the board and gives the students time to solve the problem mentally. Students start

with their fists held to their chests and indicate when they are ready with a solution by quietly raising a thumb. Once students have found an answer, they are encouraged to continue finding efficient strategies while others are thinking. They indicate that they have found other approaches by raising another finger for each solution. This quiet form of acknowledgement allows time for students to think, while the process continues to challenge those who already have an answer. When most of the students have indicated they have a solution and strategy, the teacher calls for answers. All answers—correct and incorrect—are recorded on the board for students to consider.

Students are now given the opportunity to share their strategies and justifications with their peers. The benefits of sharing and discussing computation strategies are highlighted as follows:

Benefits of Sharing and Discussing Computation Strategies

Students have the opportunity to:

1. Clarify their own thinking.
2. Consider and test other strategies to see if they are mathematically logical.
3. Investigate and apply mathematical relationships.
4. Build a repertoire of efficient strategies.
5. Make decisions about choosing efficient strategies for specific problems.

Do children come up with incorrect answers in number talks? Absolutely. However, students are asked to defend or justify their answers to prove their thinking to their peers. In number talk classrooms, students have a sense of shared authority in determining whether an answer is accurate. The teacher is not the ultimate authority, and students are expected to think carefully about the solutions and strategies presented.

In number talks, wrong answers are used as opportunities to unearth misconceptions and for students to investigate their thinking and learn from their mistakes. In a number talk classroom, mistakes play an

important role in learning. They provide opportunities to question and analyze thinking, bring misconceptions to the forefront, and solidify understanding. Helping students realize that mistakes are opportunities for learning is an important cornerstone in building a learning community.

The Teacher's Role

As educators, we are accustomed to assuming the roles of telling and explaining. Teaching by telling is the method most of us experienced as students, and we have continued to emulate this model in our own practice. Since a goal of number talks is to help students make sense of mathematics by building upon mathematical relationships, our role must shift from being the sole authority in imparting information and confirming correct answers to assuming the interrelated roles of facilitator, questioner, listener, and learner.

Since the heart of number talks is classroom conversations, it is appropriate for the teacher to move into the role of facilitator. Keeping the discussion focused on the important mathematics and helping students learn to structure their comments and wonderings during a number talk is essential to ensure that the conversation flows in a meaningful and natural manner. As a facilitator, you must guide the students to ponder and discuss examples that build upon your purposes. By posing such questions as "How does Joey's strategy connect to the ideas in Renee's strategy?" you are leading the conversations to build on meaningful mathematics.

When I began listening to my students' thinking, I realized I had much to learn about students' natural intuitions regarding numbers. Instead of only concentrating on a final, correct answer and one procedure for getting there, I began to broaden my scope to engage in listening to and learning about students' natural thinking through asking open-ended questions. My initial focus of "What answer did you get?" shifted to include "*How* did you get your answer?" I had made an assumption that all of my students solved their computation problems in the way I had taught them. While initially I was only interested in finding out their final answers to a problem such as $16 + 17$, my focus broadened to learning about *how* they arrived at their answers and *why*. Did they use the doubles of $15 + 15$ to solve $16 + 17$, or did

they combine the 10s to make 20 and then add the 13 from the total in the ones column? This was information I did not know and could use to help them look at how numbers are interrelated in different operations. By changing my question from "What answer did you get?" to "How did you solve this problem?" I was able to understand how they were making sense of mathematics.

The Role of Mental Math

Mental computation is a key component of number talks because it encourages students to build on number relationships to solve problems instead of relying on memorized procedures. One of the purposes of a number talk is for the students to focus on number relationships and use these relationships to develop efficient, flexible strategies with accuracy. When students approach problems without paper and pencil, they are encouraged to rely on what they know and understand about the numbers and how they are interrelated. Mental computation causes them to be efficient with the numbers to avoid holding numerous quantities in their heads.

An example that illustrates this idea is a common strategy for solving the problem 12×49. If students think about multiplying by a multiple of 10, they often change the 49 to 50 and multiply 12×50 for a product of 600. Since they multiplied by one extra group of 12, they subtract 12 for a final answer of 588. This strategy not only exhibits flexibility with the numbers, but is an efficient strategy that produces an accurate answer.

Another rationale for mental computation is to help strengthen students' understanding of place value. By looking at numbers as whole quantities instead of discrete columns of digits, students have to use their knowledge of place value. During initial number talks, problems are often written in a horizontal format to encourage the student's thinking in this realm. As students become accustomed to reasoning about the magnitude of numbers and utilizing place value in their strategies, the teacher may present problems both horizontally and vertically.

A problem such as $199 + 199$ helps illustrate this reasoning. By writing this problem horizontally, you encourage a student to think about and utilize the value of the entire number. A student with a strong sense of number and place value should be able to consider that 199 is close

to 200; therefore, 200 + 200 is 400 minus the two extra 1s for a final answer of 398:

$$
\begin{array}{rcrcr}
199 & + & 199 & & \\
\underline{\quad 1} & + & \underline{\quad 1} & & \\
200 & + & 200 & = & 400 \\
 & & & - & \underline{\quad 2} \\
 & & & & 398
\end{array}
$$

Recording this same problem in a vertical format can encourage students to ignore the magnitude of each digit and its place value. A student who sees each column as a column of ones would not be using real place values in the numbers if they are thinking about 9 + 9, 9 + 9, and 1 + 1:

$$
\begin{array}{r|c|c}
 & 1 & 1 \\
 & 1 & 9 & 9 \\
+ & \underline{1} & \underline{9} & \underline{9} \\
 & 3 & 9 & 8
\end{array}
$$

Six Ways to Develop Accountability

1. Ask students to use finger signals to indicate the most efficient strategy.
2. Keep records of problems posed and the corresponding student strategies.
3. Hold small-group number talks throughout each week.
4. Create and post class strategy charts.
5. Require students to solve an exit problem using the discussed strategies.
6. Give a weekly computation assessment.

Five Number Talks Goals for Grades 3–5

1. Number sense

2. Place value

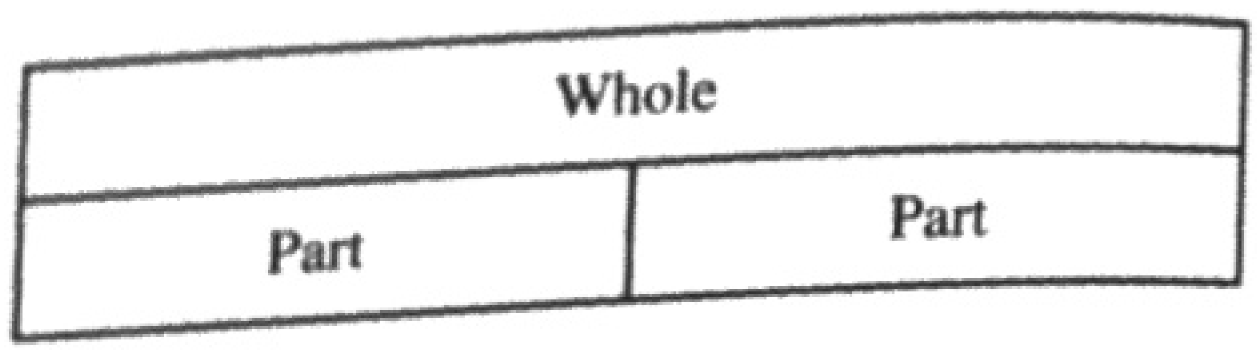
3. Fluency

4. Properties

5. Connecting mathematical ideas

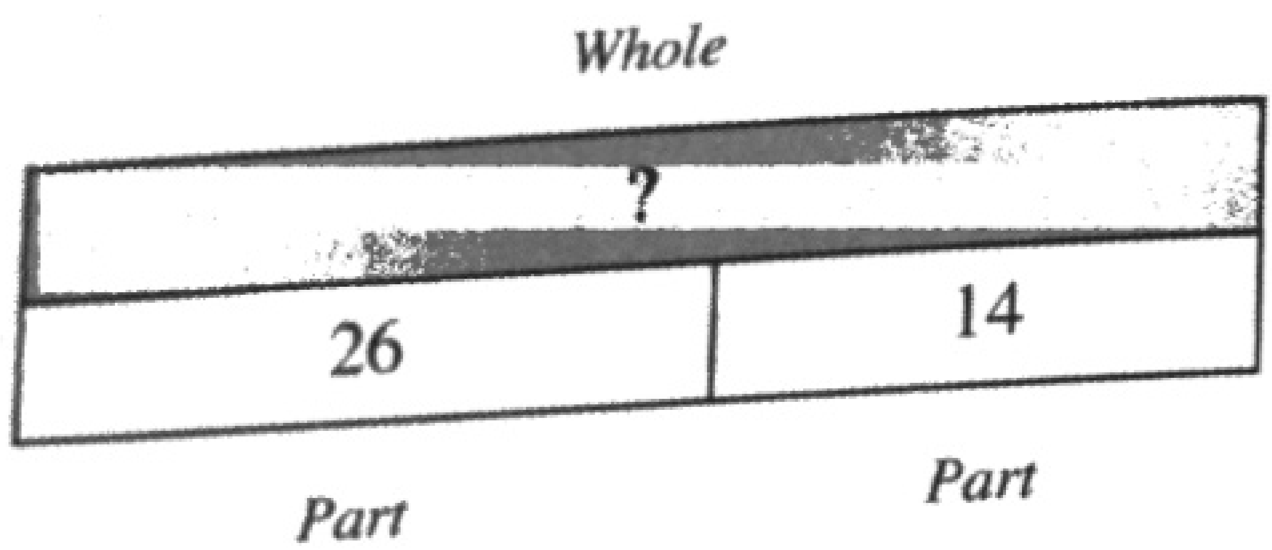
Part/Whole Box

The Part/Whole Box is a visual model that helps students consider the relationship between the parts and the whole. It is especially useful in making connections between addition and subtraction:



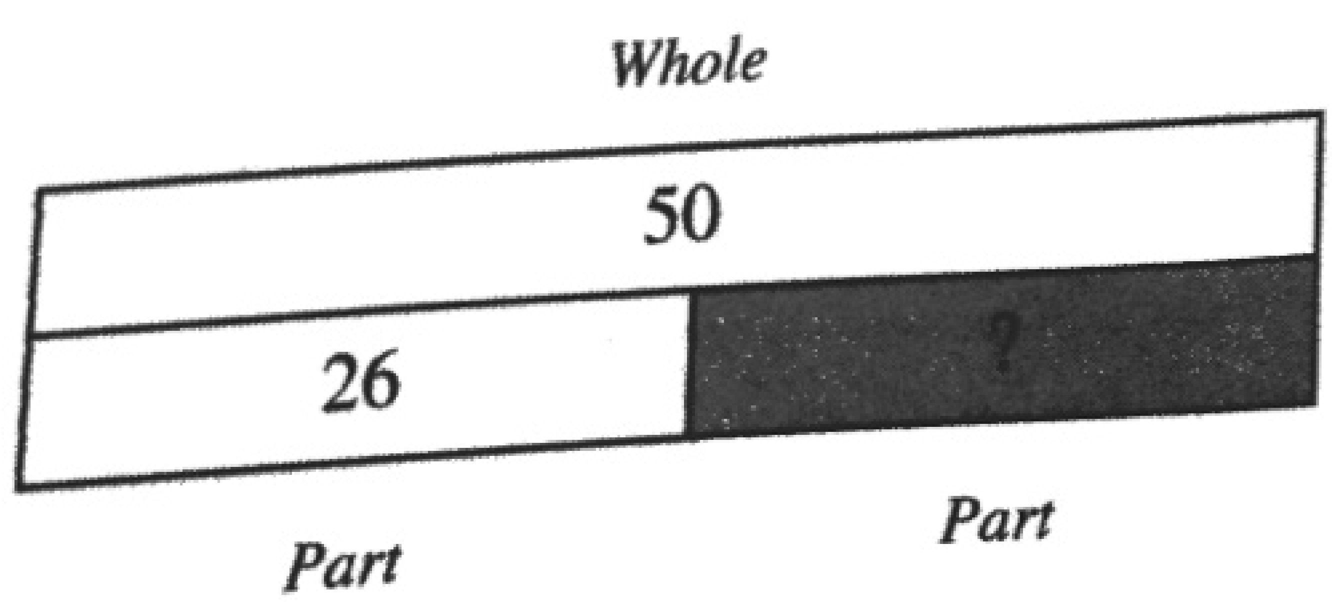
In addition, this model helps students visualize that the parts are known and the whole is the quantity to be found:

26 + 14



With subtraction, the Part/Whole Box helps identity that the whole and one of the parts are known and that the problem requires finding the unknown part:

50 – 26



Three Different Strategies for Solving 119 + 126

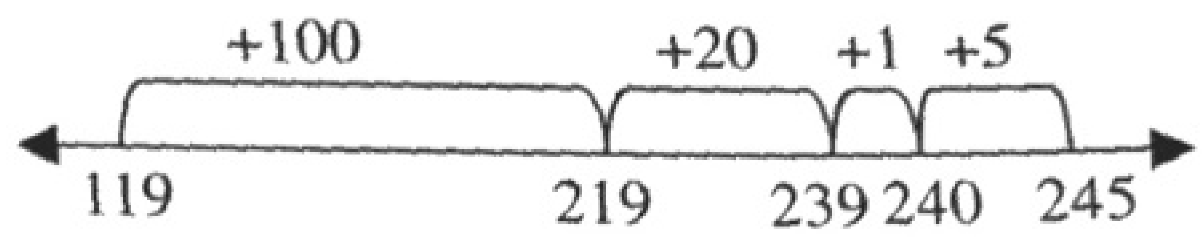
1 Student's Strategy: Breaking Each Number into Its Place Value	The Strategy as Recorded by the Teacher
Meg: I put the same numbers together.	119 + 126
Teacher: Explain what you mean.	(100 + 10 + 9) + (100 + 20 + 6)
Meg: I put all of the hundreds together, all of the tens together, and all of the ones together. So I got two hundred plus thirty plus fifteen.	100 + 100 = 200 10 + 20 = 30 9 + 6 = 15
Teacher: How did you add those numbers?	30 + 15 = 45 200 + 45 = 245
Meg: Thirty plus fifteen gave me forty-five, and two hundred plus forty-five made two hundred forty-five.	

2 Student's Strategy: Adding Up in Chunks	The Strategy as Recorded by the Teacher
Jim: I added up the numbers in a different way.	
Teacher: How did you add?	
Jim: I kept the one hundred nineteen together and added parts of the one hundred twenty-six. I	119 + 126 119 + (100 + 20 + 1 + 5)

thought about it on a number line. I first added one hundred nineteen plus one hundred, and got two hundred twenty-nine. Then I added two hundred nineteen plus twenty, and got two hundred thirty-nine. Next I added six to the two hundred thirty-nine.

Teacher: How did you add the six onto the two hundred thirty-nine?

Jim: I knew if I added one from the six to two hundred thirty-nine, I would get two hundred forty. All I needed to do was add on five more.



3 Student's Strategy: Compensation	The Strategy as Recorded by the Teacher
Taylor: I made it into an easier problem.	
Teacher: How did you make this an easier problem?	
Taylor: I took one from the one hundred twenty-six and gave it to the one hundred nineteen to change it to one hundred twenty.	$119 + 126$ $\begin{array}{ccc} 119 & + & 126 \\ \underline{+1} & & \underline{-1} \\ 120 & + & 125 = 245 \end{array}$
Teacher: Why did you choose to do this?	
Taylor: Because one hundred twenty is easier to add than one hundred nineteen. I changed the problem to one hundred twenty plus one hundred twenty-five, and that made the answer two hundred forty-five.	

Classroom Example: Discussing Efficiency with Addition Strategies

Teacher: I noticed there were a lot of signals for Strategy 3, Taylor's strategy. Could someone share why you thought this was the most efficient strategy?

Amy: He did it in two steps. That makes it quicker.

Micah: I think it was faster, too, but also confusing. I could follow Meg's strategy better.

Teacher: So even if a strategy is fast, it may not be an efficient one to use if we are unsure of why it works?

Shaun: Yes, but it makes me want to figure out how to use it.

Teacher: It looks like most of you think this is an efficient way, but you are not sure how it works. Let's try a smaller problem to test out Taylor's strategy.